

## **FIXED SHAPE RETAINER FOR ABSORBENT MATERIAL FOR STORM DRAINS**

### **FIELD OF THE INVENTION**

This present invention is directed to environmental containment and remediation  
5 technologies.

### **BACKGROUND OF THE INVENTION**

Environmental pollution can result from the release of environmentally harmful  
contaminants, for example oil and other petrochemical products, into surface water and  
groundwater aquifers. Releases into the environment can result from catastrophic  
10 accidents such as oil tanker spills and from storm water runoff from roads and parking lots.  
Once a release occurs, the contaminants need to be contained, collected and removed.

Absorbent materials have been developed to contain environmental contaminants  
released into the environment. These absorbent materials are formulated to attract and  
retain oils and can be applied as a loose granular product or can be placed in an outer fabric  
15 “sock”. The absorbent materials are deployed in parking lots, streams, roadways, lakes  
and ponds and around storm drains and catch basins.

The absorbent materials must be placed and maintained in the proper location to  
collect the contaminants. For example, oil floats on water, and the absorbent material  
should also float so that it comes into contact with the oil. In addition, absorbent  
20 materials, such as the fabric socks, are placed around storm drains and catch basins to  
intercept the flow of contaminants into the storm water system.

Granular products, however, are hard to contain. The fabric socks have no fixed  
shape, are very flexible and, therefore, can be moved under the force of running water as  
would be encountered during heavy rain events. Once moved, the contaminated water  
25 could by-pass the absorbent material and enter the storm water system. In addition, a  
dislodged fabric sock could enter the system and potentially clog a storm pipe. If the  
fabric sock becomes sufficiently waterlogged or covered with dirt and debris, it may not  
float, reducing its effectiveness.

Therefore, the need exists for a fixed shaped retainer to be used in conjunction with existing absorbent materials. The retainer would maintain the absorbent material in the proper location and would permit movement to compensate for the highly variable water flows associated with rain events. In addition, the retainer could be buoyant to  
5 assist in maintaining the absorbent material on top of the water.

## SUMMARY OF THE INVENTION

The present invention is directed to a retainer assembly that provides shape and stability to a flexible or loose remediation material. The retainer assembly anchors the remediation material in a desired location so that the remediation material is always in the  
10 proper position to provide the desired absorption or adsorption of environmental contaminants. In addition, the retainer assembly defines and permits a range of motion for the remediation material to accommodate, for example, a rising water level.

A retainer assembly in accordance with the present invention includes a retainer structure and an anchor assembly attached to the retainer structure. The anchor assembly  
15 is arranged to define the limits of motion of the retainer in three dimensions with respect to a selected anchor point. The anchor assembly also includes an attachment mechanism to secure one or more remediation materials to the retainer structure.

The retainer structure can be a buoyant structure or can be heavier than water. In addition, the retainer structure can be a fixed shape can include a plurality of sections that  
20 are moveably attached to each other so that the retainer structure is selectively positionable in a plurality of shapes.

The anchor assembly includes a plurality of spoke members and at least one tether element. The spoke members are attached to distinct locations on the retainer structure and to the tether element. The tether element is attached to the spoke members and to an  
25 anchor point to hold the retainer assembly in the desired location. The spoke members and tether elements can be rigid or flexible structures, and the connections among the retainer structure, spoke members, tether elements and anchor point can be fixed connections or releasable connections.

The attachment mechanism fixedly or releasably attaches the remediation material to the retainer structure at various points along the retainer structure. The attachment mechanism can form unitary structures with the anchor assembly or can be independent structures.

## 5 BRIEF DESCRIPTION OF THE DRAWINGS

- Fig. 1 is a perspective view from the top of one embodiment of the retainer assembly in accordance with the present invention;  
Fig. 2 is a perspective view from the bottom thereof;  
Fig. 3 is a plan view of another embodiment of the retainer assembly;  
10 Fig. 4 is a view through line 4-4 of Fig. 3;  
Fig. 5 is a cross-sectional view of another embodiment of the retainer assembly of the present invention;  
Fig. 6 is a plan view showing an embodiment of the retainer structure;  
Fig. 7 is a view through line 7-7 of Fig. 6; and  
15 Fig. 8 is a cross-sectional view of another embodiment of the retainer assembly of the present invention.

## DETAILED DESCRIPTION

- Referring initially to Figs. 1 and 2, a retainer assembly 10 in accordance with the present invention includes a retainer structure 12. The retainer structure 12 is arranged to  
20 be a substantially rigid structure that provides the necessary amount of support and imparts the desired shaped to the retainer assembly 10. In one embodiment, the retainer structure 12 is heavier than water so as to prevent the retainer assembly 10 from floating. In another embodiment, the retainer structure 12 is buoyant. The shape of the retainer structure 12 is selected depending on the application. For example, the retainer structure  
25 12 can be any fixed geometric shape including a circle, a square, a rectangle and a triangle. The retainer structure 12 can also be fixed in a unique or irregular shape defined by the application of the retainer assembly 10. In one embodiment, as illustrated, the

retainer structure 12 is a fixed circular shape. This shape is suitable for applications where the retainer assembly 10 surrounds a circular or square storm drain 14 or manhole.

In another embodiment as illustrated in Fig. 3, the retainer structure 12 is not a fixed shape but is selectively positionable in any one of a plurality of shapes. The ability  
5 of the retainer structure 12 to obtain different shapes can be a result of the material from which it is formed. For example, the retainer structure can be formed from a bendable material such as soft tubing or extruded closed cell foam. In one embodiment, the retainer structure 12 includes a plurality of sections 16 that can move or pivot with respect to each other. The sections 16 themselves, however, can be constructed of rigid  
10 material. By pivoting or rotating the sections 16, the desired shape can be obtained. As illustrated, the sections 16 are positioned to create three sides of a rectangle. This shape is suitable for applications such as catch basins 18 located adjacent curbs 20. Once placed in the desired positions, the sections 16 can then be fixed in those positions to maintain the desired shape of the retainer structure 12. Any suitable method known and  
15 available in the art of maintaining the sections 16 in the desired shape can be used.

In one embodiment, the retainer structure 12 is constructed from materials that are heavier than water. Suitable heavier than water materials include metal rods and angle iron. Preferably, the retainer structure 12 is constructed from buoyant material. Suitable  
20 buoyant materials include plastic tubing, plastic pipe, inflatable tubing, closed cell foam materials and combinations thereof. Suitable cross-sectional shapes for the material include, but are not limited to, circular (Fig. 2) and square (Fig. 4).

The retainer assembly 10 also includes an anchor assembly 22 attached to the retainer structure 12 and arranged to define the limits of motion of the retainer 12 in three dimensions, for example the three dimensions of the Cartesian coordinate system, with  
25 respect to a selected anchor point 24. The anchor point 24 is selected based upon the location or object around which the retainer assembly 10 is placed. Suitable anchor points include storm grates, manhole covers, road surfaces and surfaces adjacent to or inside grates and manhole covers.

In one embodiment as illustrated in Figs. 1 and 2, the anchor assembly 22 includes a plurality of first or spoke members 26 and at least one second member or tether element 28. Each spoke member 26 includes a first end 30 that is attached to a distinct location on the retainer structure 12. Suitable methods for attaching the first end  
5 30 to the retainer structure 12 include using fasteners, tying, gluing, bonding and combinations thereof. The attachment can be fixed or releasable. Each spoke member also includes a second end 32 opposite the first end. The second ends 32 are in contact with the tether element 28 and fixedly, moveably or releasably attached thereto. All of the second ends 32 can be attached to a single tether element, or each second end 32 can  
10 be attached to a separate tether element 28. Suitable methods for attaching the second ends 32 to the tether element 28 include using fasteners, tying, gluing, bonding and combinations thereof. The tether element 28 is also attached to the anchor point 24. In one embodiment, the tether element 28 is fixedly attached to the anchor point 24. In another embodiment, the tether element 28 is releasably attached to the anchor point 24.  
15 The lengths and arrangements of the spoke members 26 and tether elements 28 define and limit the range of motion of the retainer assembly in three dimensions.

The spoke members 26 and tether elements 28 can be constructed as rigid or flexible elements or structures. In one embodiment, both the spoke members 26 and tether elements 28 are constructed as flexible structures. In another embodiment, the  
20 spoke members 26 are constructed as rigid structures, and the tether elements 28 are constructed as flexible structures. In another embodiment, the spoke members 26 are constructed as flexible structures, and tether elements 28 are constructed as rigid structures. In yet another embodiment, both the spoke members 26 and tether elements 28 are constructed as rigid structures. Suitable flexible structures include cord, rope,  
25 cable and combinations thereof. Suitable rigid structures include rods, shafts, pipes, bars, cantilevered and gusseted arms and combinations thereof. As illustrated, the spoke members 26 and tether element 28 are constructed of flexible rope.

In another embodiment as illustrated in Figs. 3 and 4, both the spoke members 26 and tether elements 28 are rigid structures. As illustrated in this embodiment, the retainer

assembly includes a plurality of spoke members 26 and a plurality of tether elements 28, wherein each spoke member 26 is associated with a separate tether element 28. In this embodiment, each tether element 28 is a substantially rigid shaft that is anchored into the ground or surface adjacent a catch basin 18. Each spoke member includes at least one  
5 hole 24 disposed adjacent the second end 32, and the tether element 28 extends through the spoke member hole 34. Since each spoke member 26 can move along the shaft 28, the retainer assembly can move in a direction 36 that is parallel to the length of the shaft 28. Motion perpendicular to this direction 36 is prevented. The shaft can also include an enlarged distal end 38 that prevents movement of the spoke member 26 past one end of  
10 the shaft 28. Movement along the shaft in the opposite direction is limited by the ground. Thus, the limits of motion in three dimensions are defined. This arrangement of first and second members 26,28 also contributes to the rigidity of a retainer structure 12  
embodiment containing a plurality of moveable sections 16.

The retainer assembly 10 also includes an attachment mechanism 40 to secure one  
15 or more remediation materials 42 to the retainer structure 12. The attachment mechanism 42 can be arranged to provide for fixed attachment of the remediation material 42 to the retainer structure 12 or to provide for releasable attachment of the remediation material 42 to the retainer structure 12. Suitable attachment mechanisms include mechanical fasteners, hook and loop type fasteners, adhesives, cable ties, straps and combinations  
20 thereof. In one embodiment, the attachment mechanism 42 includes a plurality of straps. A sufficient number of straps, disposed around the retainer structure 12, are provided to adequately anchor the remediation material 42 to the retainer structure 12. The attachment mechanism 40 can be a separate structure or as illustrated in Figs. 2 and 4, or can form a unitary structure with one or more spoke members 26.

25 In one embodiment as illustrated in Fig. 5, the attachment mechanism 40 includes at least one tray member 44 attached to the retainer structure 12 and arranged to hold the remediation material 42. The tray member 44 can be a porous structure, for example a trough with holes or a mesh material, to allow liquid to come into contact with the remediation material 42. The cross sectional shape of the tray member 44 is selected to

accommodate the remediation material 42. In one embodiment, the size and shape of the tray member 44 is selected to provide a force-fit between the tray member 44 and the remediation material 42 to help secure or hold the remediation material 42. The attachment mechanism can also include a lid element 46 pivotally attached to the tray structure to prevent the remediation material 42 from falling or floating out of the tray member 44. This embodiment is particularly well suited for remediation material 42 that is provided as a granular or fiber material or as a plurality of fabric sheets.

In another embodiment as illustrated in Fig. 8, the attachment mechanism 40 includes at least one slot 48 and cavity 50 in the retainer structure 12 sufficient to accept and to accommodate the remediation material 42. In this embodiment, the retainer structure 12 is preferably arranged as a porous material, for example as a foam material such as closed cell foam.

As illustrated, the retainer assembly 10 can be arranged to have the remediation material 42 located on top of (Fig. 1), underneath, or beside (Figs. 3-5) the retainer structure 12. The retainer structure 12 can also be arranged to envelope or surround the remediation material 42. In an embodiment as illustrated in Figs. 6 and 7, the retainer structure 12 is disposed inside the remediation material 42. In this embodiment, the remediation material 42 can include one or more slots (not shown) to facilitate insertion of the retainer structure 12 into the remediation material 42, and the retainer structure provides to desired shape, rigidity and buoyancy to the remediation material 42. In addition, a separate attachment mechanism 40 is not required, because the location of the retainer structure 12 inside the remediation material 42 provides for attachment.

Suitable remediation material 42 for use with the retainer structure 12 includes materials that provide the desired absorption or adsorption of contaminants. Examples of these suitable materials include, but are not limited to, oleophilic, oleophobic, hydrophobic and hydrophilic materials, polymers, activated charcoal, spun glass and combinations thereof. These materials can be provided in any desired form including granular, fibrous and sheet form. In addition, the material can be provided loose or contained or enclosed in a porous container. In one embodiment, the remediation

material is fixed to the retainer structure 12 and included in the retainer assembly 10. In this embodiment, the remediation material 42 is constructed as one or more tubular fabric structures comprising an oleophilic material.

While it is apparent that the illustrative embodiments of the invention disclosed  
5 herein fulfill the objectives of the present invention, it is appreciated that numerous modifications and other embodiments may be devised by those skilled in the art. Additionally, feature(s) and/or element(s) from any embodiment may be used singly or in combination with other embodiment(s). Therefore, it will be understood that the appended claims are intended to cover all such modifications and embodiments, which  
10 would come within the spirit and scope of the present invention.